REMARKS/ARGUMENTS

The Pending Claims

The pending claims are directed to a method of chemically-mechanically polishing a substrate. Claims 1-3, 6-10, 13-19, 21, and 32-39 are currently pending. Reconsideration of the pending claims is respectfully requested.

Discussion of the Claim Amendments

Claims 1, 36, and 39 have been amended to recite that the polishing system does not comprise a component having a standard redox potential that is greater than the standard redox potential of the metal in an oxidized form. Support for this amendment can be found in the specification at paragraph 27. New claims 40-43 have been added. New claims 40-43 further specify that the polishing system recited in claims 1, 36, 38, and 39, respectively, has a pH in a specified range. Support for new claims 40-43 can be found in the instant specification at paragraph 29. No new matter has been added by way of these amendments.

Summary of the Office Action

The Office Action rejects claims 1-3, 6-10, 13-19, 21, and 32-39 as allegedly unpatentable over U.S. Patent 6,139,763 (Ina et al.) (hereinafter "the Ina '763 patent") in view of U.S. Patent Application Publication 2002/0086511 A1 (Hartner et al.) (hereinafter "the Hartner '511 publication"). The Office Action also rejects claim 38 as allegedly unpatentable over U.S. Patent Application Publication 2002/0090820 A1 (Sun et al.) (hereinafter "the Sun '820 publication") in view of the Hartner '511 publication and the Ina '763 patent.

Discussion of the Obviousness Rejections

The rejected claims are directed to a method of polishing a substrate comprising a noble metal oxide by use of a chemical-mechanical polishing system comprising a polishing component (i.e., an abrasive, a polishing pad, or both), a particular reducing agent, and a liquid carrier.

The Office Action asserts that the Ina '763 patent discloses a method of polishing a metal in an oxidized form, comprising contacting a portion of the substrate with a polishing pad and a polishing composition comprising abrasive particles and a reducing agent. The Office Action acknowledges that the Ina '763 patent fails to disclose that the metal in oxidized form may be a noble metal, but asserts that such a method would be obvious in view of the Hartner '511 publication.

As is well-settled, in order to establish a *prima facie* case of obviousness with respect to a claim, at least two basic criteria must be met: (1) there must be some suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings, and (2) there must be a reasonable expectation of success.

The Office Action, however, fails to demonstrate that (a) there is a suggestion or motivation to modify the disclosures of the Ina '763 patent and the Hartner '511 publication, and (b) there is a reasonable expectation of success on making such a modification.

The Ina '763 patent is generally directed to a polishing composition which is capable of polishing a tantalum-containing compound layer at a high stock removal rate (the Ina '763 patent at col. 3, lines 20-24). The Ina '763 patent discloses a polishing composition comprising (a) an abrasive, (b) an oxidizing agent capable of oxidizing tantalum, (c) a reducing agent capable of reducing tantalum oxide, and (d) water. The Ina '763 patent provides that the reducing agent which is capable of reducing tantalum oxide formed by the oxidizing agent is selected from the group consisting of formic acid, oxalic acid, and formaldehyde (the Ina '763 patent at col. 6, lines 30-32).

However, nothing within the Ina '763 patent teaches or suggests a polishing system comprising a reducing agent for polishing a metal in an oxidized form, wherein the metal is a noble metal, and wherein the polishing system does not comprise a component having a standard redox potential that is greater than the standard redox potential of the metal in an oxidized form. The Ina '763 patent teaches that, when the disclosed polishing composition is brought into contact with a tantalum-containing compound layer, an oxidizing reaction and a reducing reaction may simultaneously proceed on the surface of the layer. The oxidizing agent oxidizes the surface of the tantalum-containing compound layer, and the reducing agent

reduces the formed tantalum oxide to produce a "tantalum-containing compound layer in a readily polishable state" (the Ina '763 patent at col. 9, lines 40-52).

In order for a chemical oxidation reaction to occur, at a given pH, a material must be contacted with an agent having a standard redox potential that is greater than the standard redox potential of the material in the oxidized form. Otherwise, the agent will not oxidize the nonoxidized material, i.e., oxidation cannot occur. Each of the oxidizing agents recited in the disclosure of the Ina '763 patent have a standard redox potential that is greater than the standard redox potential of tantalum in the oxidized form. In contrast, the pending claims require, among other things, that the polishing system does not comprise a component having a standard redox potential that is greater than the standard redox potential of the metal in an oxidized form. That is, the pending claims exclude the presence of an oxidizing agent for a metal (e.g., a noble metal). Nothing within the Ina '763 patent teaches or suggests that the polishing composition disclosed therein can be used without an oxidizing agent for the metal being polished.

The Office Action relies on the Hartner '511 publication for its disclosure that iridium oxide can be polished using a chemical-mechanical polishing (CMP) step, but acknowledges that the Hartner '511 publication fails to teach that any special CMP process is necessary to polish the iridium oxide layer. The Office Action asserts that the silence of the Hartner '511 publication makes it obvious to the ordinarily skilled artisan to employ *any* CMP process, particularly the process disclosed in the Ina '763 patent, to polish iridium oxide. However, the teaching or suggestion to modify or combine references must be found in the references themselves, as opposed to an applicant's disclosure. The Office Action has improperly imputed the presence of such a teaching or suggestion in the Hartner '511 publication from the absence of any direction as to a suitable polishing method whatsoever.

Even assuming *arguendo* the propriety of combining the Ina '763 patent and the Hartner '511 publication, the Hartner '511 publication fails to cure the deficiencies of the Ina '673 patent. As noted above, the Hartner '511 publication is completely silent as to the details of the CMP step. Thus, the Hartner '511 publication does not teach or suggest a polishing system for a metal in an oxidized state, wherein the metal is a noble metal, wherein the polishing system comprises a particular reducing agent, and wherein the polishing system

does not comprise a component having a standard redox potential that is greater than the standard redox potential of the metal in an oxidized form (e.g., an oxidizing agent for the metal).

For the foregoing reasons, the obviousness rejection of claims 1-3, 6-10, 13-19, 21, and 32-39 is improper and should be withdrawn.

The Office Action further asserts that claim 38 is unpatentable over the Sun '820 publication in view of the Hartner '511 publication and the Ina '763 patent.

The Office Action relies on the Sun '820 publication for its disclosure of a method for chemical-mechanical polishing with a polishing composition comprising abrasive particles, a reducing agent, and water, wherein the polishing composition does not contain an oxidizing agent. The Sun '820 publication is generally directed to a polishing composition and a polishing method for selective removal of a barrier layer (e.g., tantalum) on a substrate comprising a dielectric layer (e.g., silicon dioxide). The reducing agent can be, *inter alia*, oxalic acid (the '820 publication at paragraph 50). Thus, the Sun '820 publication fails to disclose the polishing of a noble metal in oxidized form or the use of one of the reducing agents as recited in claim 38.

In an effort to satisfy the deficiencies of the Sun '820 publication vis-à-vis the method defined by claim 38, the Office Action relies on (a) the Hartner '511 publication for its disclosure that a metal in an oxidized form (e.g., iridium oxide) can be polished with a CMP step, and (b) the Ina '673 patent for its alleged disclosure that formaldehyde and formic acid (which are recited in claim 38) are obvious equivalents of the oxalic acid (which is not recited in claim 38 but is recited in the Sun '820 publication).

As noted above, the Sun '820 publication is generally directed to a method and composition for removing a barrier layer from an underlying dielectric layer. The CMP method comprises two steps: a first step for removing copper (the Sun '820 publication at paragraphs 36 and 40), and a second step for selectively removing a barrier layer such as tantalum, which is a metal rather than an oxidized metal, from an underlying dielectric layer (the Sun '820 publication at paragraph 37). The Office Action asserts that silicon dioxide is a semimetallic element in an oxidized state and, therefore, is similar to a metal in an oxidized

form. However, if the silicon dioxide of the Sun '820 publication is analogous to the oxidized noble metal of claim 38, then the Sun '820 publication teaches away from the method of polishing an oxidized noble metal as defined by claim 38. In particular, the Sun '820 publication teaches that the reducing agent is selective for the barrier (e.g., tantalum) layer versus the dielectric (e.g., silicon dioxide) layer, i.e., the reducing agent facilitates the removal of substantially all of the tantalum material (e.g., barrier layer) while *minimizing* removal of the dielectric layer (the Sun '820 publication at paragraphs 37 and 59). Thus, one of ordinary skill in the art seeking to polish an oxidized noble metal would not look to the disclosure of the Sun '820 publication.

If, nonetheless, one of ordinary skill did look to the Sun '820 publication, the ordinarily skilled artisan would not then consider the disclosure of the Hartner '511 publication for the purposes of modifying the method disclosed in the Sun '820 publication. The Hartner '511 publication teaches a method wherein a layer of a barrier material, such as iridium oxide, is deposited over a patterned silicon dioxide layer, and the excess barrier material is then removed by a CMP step (the Hartner '511 publication at paragraphs 42 and 43). Although the same term "barrier" is used in the Hartner '511 and the Sun '820 publications, the material comprising the barriers differs and is, for example, iridium oxide in the Hartner '511 publication and tantalum in the Sun '820 publication. As a result, one of ordinary skill in the art, utilizing the method disclosed in the Sun '820 publication, would not look to the Hartner '511 publication for guidance in modifying the method disclosed in the Sun '820 publication. Furthermore, using the Office Action's reasoning that iridium oxide and silicon dioxide are both oxidized metals, the ordinarily skilled artisan would conclude that the method of the Sun '820 publication would result in *suppression* of the removal of the iridium oxide disclosed in the Hartner '511 publication. Such a result would be contrary to the desired polishing of an oxidized noble metal.

The Ina '763 patent similarly fails to cure the deficiencies of the Sun '820 publication. As noted above, the Office Action relies on the Ina '763 patent for its disclosure of formaldehyde and formic acid as allegedly obvious equivalents of oxalic acid as reducing agents. The ordinarily skilled artisan would expect that substitution of formaldehyde or formic acid for oxalic acid in the polishing composition of the Sun '820 publication would lead to the same result, namely, *suppression* of the removal of silicon dioxide and, by analogy

based on the Office Action's reasoning, an oxidized noble metal such as iridium oxide. Again, this would be contrary to the desired polishing of an oxidized noble metal.

Under the circumstances, the subject matter of claim 38 cannot be considered obvious in view of the combined disclosures of the Sun '820 publication, the Hartner '511 publication, and the Ina '763 patent.

Further, an obviousness rejection of the other pending claims, i.e., claims 1-3, 6-10, 13-19, 21, 32-37, and 39, would not be appropriate in view of the combined disclosures of the Sun '820 publication, the Hartner '511 publication, and the Ina '763 patent. As discussed herein, pending claims 1-3, 6-10, 13-19, 21, 32-37, and 39 have been amended to exclude a component having a standard redox potential that is greater than the standard redox potential of the metal in an oxidized form. The same comments regarding the obviousness rejection of pending claim 38 in view of the Sun '820 publication, the Hartner '511 publication, and the Ina '763 patent would be equally applicable to an obviousness rejection of pending claims 1-3, 6-10, 13-19, 21, 32-37, and 39.

Conclusion

Applicants respectfully submit that the patent application is in condition for allowance. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,

John Kilyk, Jr., Reg. No. 30,763
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

Date: April 26, 2006